CLOSE APPROACHES OF STARS TO THE SOLAR SYSTEM

J. Garcia-Sanchez, P. R. Weissman, R. A. Preston, D. L. Jones (NASA Jet Propulsion laboratory), J.-P. Lestrade (Observatoire de Paris-Meudon/CNRS), D. W. Latham and R. P. Stefanik (liar\'arcl-S~l~ itl~so~lial] Center for Astrophysics)

We have combined Hipparcos proper motion and parallax data for nearby stars with ground-based radial velocity measurements to find stars which may have passed (or will pass) close enough to the Sun to perturb the Oort cloud. Close stellar encounters could deflect large numbers of comets into the planetary region and raise impact rates on the planets and their satellites, with possible consequences for biological evolution on the Earth. From the data analyzed to date, we find that the number N of close stellar approaches within a distance D from the Sun (measured in parsecs) is given by $N \approx 4.3\ D^2\ Myr^{-}$ *, somewhat less than previously predicted values. This is likely the result of observational incompleteness in the Hipparcos data, which is complete to a visual magnitude of only ~7.3 9.() and has a limiting magnitude of ~12.4. Only two stars, Gliese 710 and SAO 128711, are found with predicted closest approach distances < 1@ AU (0.5 parsecs), through the outer Oort cloud, although several stars come within about 1 parsec during a ±1.5 Myr interval. The predicted minimum distance for Gliese 710 is 71,000 AU, 1.4 Myr in the future. For SAO 128711 the numbers are 57,000 AU, 1.2 Myr in the past, though the uncertainties are quite large. Both of these stars are red dwarfs with masses of ~0.4 0.7 $M_{\odot}$. The absence of major stellar perturbers in the recent past is consistent with analyses of the orbital element distributions of long-period comets by Weissman (1993 *BAAS* 25, 1063) which determined that we are not currently in a cometary shower. Based on dynamical simulations, the closest predicted stellar passages may result in an increase of the flux of new comets from the Oort cloud of ~50%. In most cases the uncertainty in our estimated closest approach distances is dominated either by uncertainties in published radial velocity measurements or by uncertainties in the barycentric motion of binary systems. We have begun a program to obtain radial velocities for stars in our sample with no previously published values.

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